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Executive Body for the Convention on Long-range
Transboundary Air Pollution

**Steering Body to the Cooperative Programme for
Monitoring and Evaluation of the Long-range
Transmission of Air Pollutants in Europe**

Working Group on Effects

Fourth joint session

Geneva, 10-14 September 2018

Item 13 (b) of the provisional agenda

**Progress in activities of the Cooperative Programme for
Monitoring and Evaluation of the Long-range
Transmission of Air Pollutants in Europe in 2018
and future work: measurements and modelling**

Measurements and modelling

Report of the Task Force on Measurements and Modelling on its nineteenth meeting

Summary

The present document contains the annual report of the Task Force on Measurements and Modelling under the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe, in accordance with the 2018-2019 workplan for the implementation of the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/140/Add.1, items 1.1.1.1-1.1.1.4, 1.1.1.7, 1.1.2.1, 1.1.2.2, 1.1.3.2, 1.1.4.1, 1.2.1, 1.3.2, 1.4.2), and activities set out in the informal document submitted to the Executive Body for the Convention at its thirty-seventh session entitled “Draft revised mandates for scientific task forces and centres under the Convention”. It summarizes the discussion at and the outcomes of the Task Force’s nineteenth meeting, held from 2 to 4 May 2018 in Geneva.

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I. Introduction

1. This report presents the outcome of the nineteenth meeting of the Task Force on Measurements and Modelling, held from 2 to 4 May 2018 in Geneva, including the presentation of activities undertaken since the previous Task Force meeting (Prague, Czech Republic, 3-5 May 2017). It describes progress in implementation of the current monitoring strategy of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) (ECE/EB.AIR/2009/16/Rev.1); in its revision; and in the development of modelling tools and specific ongoing assessments (a heavy metals pilot study, field campaign and twin sites activities), as well as current and potential collaborative activities with other bodies of the Convention on Long-range Transboundary Air Pollution.

2. Fifty-one experts from the following Parties to the Convention on Long-range Transboundary Air Pollution attended the meeting: Austria, Belarus, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, France, Germany, Hungary, Italy, Netherlands, Norway, Poland, Republic of Moldova, Russian Federation, Slovakia, Spain, Sweden and Switzerland. Also present were representatives from four EMEP centres (the Chemical Coordinating Centre (CCC), the Meteorological Synthesizing Centre-East (MSC-E), the Meteorological Synthesizing Centre-West (MSC-W) and the Centre for Integrated Assessment Modelling (CIAM)), the European Environment Agency, the Task Force on Integrated Assessment Modelling, the European Commission Joint Research Centre and the World Meteorological Organization (WMO).

3. Mr. Augustin Colette (France) and Ms. Oksana Tarasova (WMO) chaired the meeting. They presented the agenda, highlighted the activities carried out since the previous meeting, outlined the ongoing evolution of EMEP and drew attention to the Task Force's mandate and key elements of the workplan for 2018-2019.

4. The meeting was hosted jointly by WMO and the Swiss Confederation. It was opened by Ms. Oksana Tarasova, Chief of the WMO Atmospheric Environment Research Division, who gave a presentation on the activities of the Global Atmosphere Watch (GAW) Programme that were most relevant to the work of the Task Force, including observations, modelling, capacity-building and outreach, and described a number of applications (including sand-and-dust and air quality forecasting and support for climate mitigation) based on atmospheric chemical composition information. An expert from Switzerland gave an overview of the activities of the Federal Office for the Environment with regard to air quality management, highlighting the key features of the various levels of the air quality monitoring networks and of modelling activities (including the use of EMEP models, country-specific mapping for health exposure and ecosystem impact assessment, and contributions to the Task Force's Eurodelta modelling framework.¹ He also stressed the impact of urbanization on the quality of observational data.

5. On behalf of the Chair of the EMEP Steering Body, the Chair of the Task Force provided an update on EMEP activities, highlighting the draft mandates of the EMEP task forces and centres and focusing on the short- and long-term recommendations drawn from

¹ See Meteorologisk Institutt, EMEP wiki, EURODELTA/TFMM trend modelling. Available from <https://wiki.met.no/emep/emep-experts/tfmmtrendeurodelta> (accessed 18 June 2018).

the Saltsjöbaden VI workshop.² The following issues of relevance to the Task Force were also brought to the attention of the participants: global air quality monitoring, the interaction of air pollution on different scales and the importance of transboundary air pollution for urban scale. He informed the Task Force of changes in the organization of the Working Group on Effects Coordination Centre for Effects and the need to better link EMEP with the Working Group's activities. He also emphasized the increasing role of outreach activities; cooperation with other organizations, including United Nations Environment Programme (UNEP), the Arctic Monitoring and Assessment Programme (AMAP) (on black carbon impacts in the Arctic and on mercury), the Stockholm Convention on Persistent Organic Pollutants and the Copernicus Atmospheric Monitoring Service; and near-real-time observational data in order to achieve the objectives of the Convention. Funding aspects were also briefly discussed. The expert drew attention to the data questionnaire that would be sent to Parties' representatives to the Working Group on Strategies and Reviews in order to better shape the priorities of the workplan. Particular emphasis was placed on the expected contribution of the Task Force to the updating of the monitoring strategy for the period 2020-2029 and the efforts to improve the handling of condensables pursuant to the Convention.

6. The Chair of the Task Force on Integrated Assessment Modelling (TFIAM) gave a presentation in response to a request from the Executive Body for the Convention that TFIAM and the Task Force should collaborate in producing a thematic assessment report on ammonia. He highlighted the work carried out by the Task Force on Reactive Nitrogen and the need to take stock of the scientific findings (on atmospheric ammonia and its impacts on ecosystems and on health) and to identify the most effective policy actions, particularly those that can lead to further economic efficiency in enhancing ammonia uptake in agricultural ecosystems and avoiding the discharge of waste to the atmosphere. One of the meeting's recommendations was that this report should be disseminated as part of the broader international agenda in the context of the Sustainable Development Goals.

II. Modelling activities, including national contributions

7. A representative of MSC-W described the development of the EMEP model. The focus was on the use of 0.1 x 0.1 longitude-latitude degree resolution emission inventories submitted by Parties. The benefit in terms of model performance at both EMEP and urban monitoring stations was discussed. Parties were encouraged to assess the high-resolution model results, comparing them with additional (not EMEP) observations. These model results will be made available in the country reports. Parties were further encouraged to provide feedback and information on national mapping strategies to the Centre on Emission Inventories and Projections and MSC-W. Improvement in model performance is expected with higher temporal resolution achieved and more Parties reporting high resolution gridded emissions. Further benefit is expected in the coming years thanks to collaboration with the Copernicus Atmosphere Monitoring Service on emission mapping and, in particular, to the parameterization of emission height and temporal distribution. Another MSC-W expert gave a presentation on the state of the art in modelling organic aerosols and the need for progress in defining condensables in emission inventories for the residential and traffic sectors. He highlighted the disparities in current assumptions used to report

² See <http://saltsjobaden6.ivl.se/>.

particulate matter (PM) and proposed that as a first step, all Parties should clarify their approaches to reporting (what is and is not included).

8. A representative of MSC-E described recent developments in the areas of heavy metals and persistent organic pollutant modelling. An inverse modelling methodology that relies on source receptor matrices had been used in order to estimate cadmium emissions over Poland. A comparison of the modelled and observed seasonal cycles of the urban increment suggested that residential emissions needed to be improved. National case studies will be launched in the United Kingdom of Great Britain and Northern Ireland, for heavy metals, and in Germany, for mercury and the contribution of mercury deposition to surface waters and catchment areas in connection with the Working Group on Effects. A representative of Croatia stressed that there was a substantial communications gap and lack of collaboration; closer dialogue between national emission compilers and the Task Force community was needed in order to identify the causes of the difference between observed levels of pollutants and calculations that use emission inventories as input. This gap should be brought to the attention of the Executive Body.

9. Another representative of MSC-E gave an overview of progress in persistent organic pollutant modelling in the EMEP domain. The discussion focused on benzo(a)pyrene (BaP) modelling, the main features of reported emissions and the comparison of model results and measurements in France and Spain. Model assessment of pollution based on official emissions provides unsatisfactory results in some EMEP countries (France, Germany, Poland and Spain); analysis and reduction of uncertainty, in cooperation with national experts, are required. Sensitivity simulations have shown that there is considerable uncertainty with regard to residential combustion. Future national case studies on BaP modelling might be conducted in Germany, Poland or Croatia.

10. Experts from France and Spain gave a joint presentation on the results of a comparison between their modelling of BaP and the mapping of MSC-E. Systematic deficiencies raised issues with the emission inventories, but those differences were also model-specific. The main difference in model formulation concerned gas/aerosol partitioning.

11. An expert from Belarus presented new modelling on particles with an aerodynamic diameter equal to or less than 10 micrometres (PM₁₀) in the Zhlobin area, including assessment of the main contributing activity sector, verification and observations. An expert from Italy gave an overview of EMEP monitoring activities, particularly for carbonaceous aerosols, and modelling for the short (air quality forecasts) and long term in support of decision-making. The primary focus for model development is currently the deposition of inorganic aerosols and ozone to ecosystems. An expert from the Netherlands presented his work on ammonia modelling, particularly at high spatial resolution, including comparison with a dense network of passive samplers. Another expert from the Netherlands presented an operational modelling service which tracks the emission sources that contribute to day-to-day air pollution variability.

III. Monitoring activities, including national contributions

12. A representative from WMO introduced a statement on low-cost sensors for the measurement of atmospheric composition. The Task Force had been invited to comment on an earlier draft in advance of the meeting, and a few of its representatives were also among the contributors. This document is based on peer-reviewed literature that reflects the most recent experience with the performance of low-cost sensors and sensor systems, describes

current and potential application areas for such systems and provides expert advice on the measures required in order to improve their performance. The Task Force decided to recommend that EMEP endorse the document, which will be presented to the WMO Executive Council in June 2018. Its executive summary will be translated into five of the official languages of the United Nations.

13. A representative of Bulgaria gave an overview of activity related to EMEP; two monitoring stations were reporting ozone to CCC and performing additional monitoring, particularly with regard to precipitation chemistry. Recent progress in modelling was also presented. A representative of Switzerland described ways in which innovative statistical approaches, such as random forest classification, can be used to assess the impact of meteorology on long-term PM₁₀ trends.

IV. Thematic session on long-range transport and urban air pollution

14. In light of the Saltsjöbaden VI workshop's recommendation that an Expert Panel on Clean Cities should be established, the Chair of TFIAM introduced a thematic session on long-range transport and urban air pollution with a presentation on assessing the efficiency of mitigation measures taken at the city or national level. He stressed that policy-making tends to focus on the health impacts of air pollution; different approaches are needed in order to reduce the levels of various pollutants. Current air quality policies were developed at the national level with limited involvement of urban stakeholders. However, because cities have a limited influence on local exposure, national and international action is also needed.

15. An expert from Spain presented the Twin Site methodology for assessing the local/non-local contribution of air pollution to urban air from observation and providing information on the main activity sectors. This approach relies on incremental decomposition (the so-called "Lenschow" approach) applied to the positive matrix factorization (PMF) decomposition of fine chemical characterisation of aerosols. It was applied to observations at paired or tripled sites in France, Germany, the Netherlands, Spain and Switzerland. Overall, the non-local contribution to air pollution ranged from 60 to 80 per cent. The details will be presented in a report to be issued by the end of 2018. Experts from other countries indicated that this was one of the possible methods for understanding urban emissions and noted that it relied fundamentally on the correct choice of "background" condition for the specific city.

16. An expert from CIAM described the Greenhouse Gas Air Pollution Interactions and Synergies (GAINS) model methodology for assessing local/non-local contributions to air pollution and provided a comparison with the observation-based estimate from the previous presentation. An expert from the European Commission Joint Research Centre explained how the Screening for High Emission Reduction Potential on Air (SHERPA) tool can be used to assess urban increment, urban impact, city spread and background deviation that cannot be derived from the Lenschow methodology. An expert from France gave an assessment of the ability of EMEP and of the multi-scale chemistry-transport model for atmospheric composition analysis and forecast (CHIMERE) to capture both observed urban/rural gradients in total PM₁₀ and individual chemical species used in the Twin Site analysis.

17. An expert from Norway presented a downscaling technique for modelling nitrogen dioxide at very high resolution, keeping track of the local/non-local contribution to air

pollution by using EMEP source receptor matrices with subsequent spatial downscaling within the grid. Downscaling can be applied to annual and hourly data; emission proxy data are used where available so that large regions can be modelled at high resolution. The method can also be applied to air quality forecasts or used to assess the representativeness of a monitoring site, provided that high resolution traffic activity data is available.

V. Thematic session on the revision of the monitoring strategy

18. A representative of CCC gave an overview of the achievements of the EMEP, highlighting the high visibility of the Programme and its use to support implementation of the Convention. A proposal for the revision of the EMEP monitoring strategy, circulated to the Task Force in advance of the annual meeting, had allowed experts to exchange views on the subject. The proposal had also been discussed in connection with the technical details of the monitoring strategy and siting criteria. National representatives were encouraged to provide feedback in writing following the initial discussion so that a consolidated revision could be presented to the EMEP Steering Body in September 2018, with a final draft approved by the Task Force in 2019 for consideration and adoption by the Executive Body in December 2019.

VI. Thematic session on carbonaceous aerosols

19. A representative of CCC gave an overview of the winter 2017-2018 joint EMEP/Aerosols, Clouds, and Trace gases Research InfraStructure Network (ACTRIS)/Chemical On-Line cOmpoSition and Source Apportionment of fine aerosol (COLOSSAL) field campaign.³ The focus was on improving the characterization of fossil fuel and biomass burning contributions in observed black carbon concentration throughout Europe. An encouraging involvement of Parties was reported with 22 contributing countries and 57 sites, including urban areas, as a benefit of the collaboration with ACTRIS and the COLOSSAL European Cooperation in Science and Technology (COST) Action. The final results, to be presented at the next meeting of the Task Force, will pave the way for a potential multi-model experiment designed to benchmark black carbon emission inventories and to improve the modelling of condensables. The modelling plan on the use of campaign data should be developed in time for the next meeting of the Task Force.

20. A representative of Estonia described the outcome of a detailed field campaign on residential heating, accompanied by a modelling analysis. A potential pollution source attributed to waste burning in household heaters was identified. An expert from Switzerland presented the outcome of a particulate matter chemistry field campaign conducted in Krakow, Poland, which will be interesting to monitor until the planned ban on solid fuel burning in the city comes into force in 2019.

VII. Thematic session on links between EMEP and the Working Group on Effects

21. An expert from Spain presented a comparison between modelled and observed deposition of sulphur and nitrogen in Europe, a joint activity between the Task Force and

³ See <https://www.actris.eu/Events/Campaigns.aspx>.

the Task Force on Hemispheric Transport of Air Pollution. The response of deposition to emission changes appears to be quite linear. The potential inclusion of air pollutant deposition observations collected by the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests) was discussed. An expert from France presented the deposition monitoring activities of EMEP and the Working Group on Effects and an analysis of these data in terms of trends and mapping, including with regard to critical load exceedances (which remain important throughout the country).

22. A representative of MSC-W described the Centre's work on impact assessment, particularly with regard to ozone deposition with the use of photosynthetic ozone dose flux computation, emphasizing the sensitivity of that metric to thresholding effects and therefore recommending the use of intermediate thresholds in models.
